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At the Heart of the Vietnam War: Herbicides, Napalm and Bulldozers Against the A Lưới Mountains

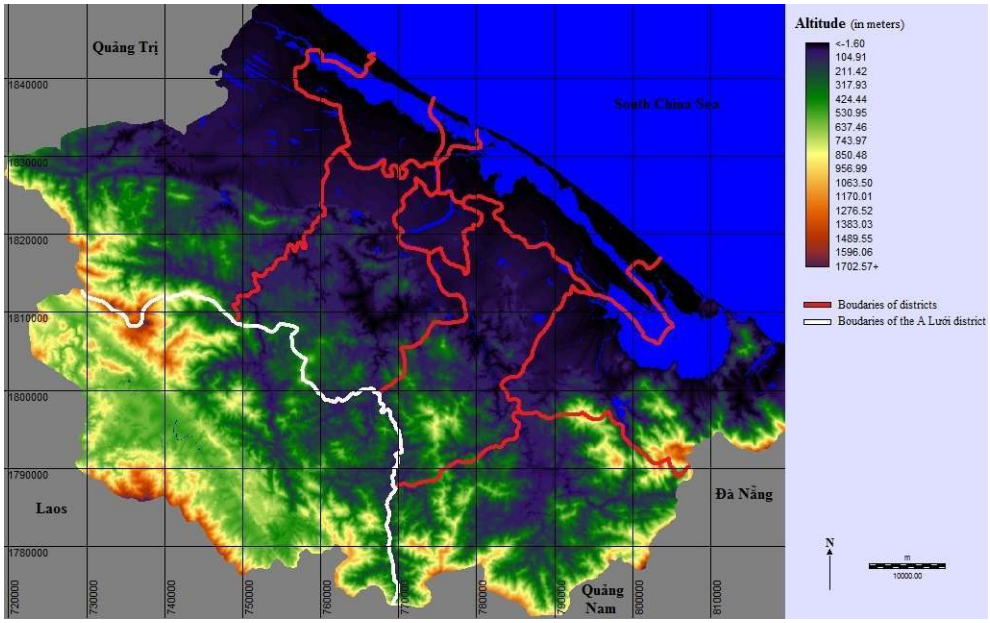
Amélie Robert

Introduction

1 The A Lưới Mountains are located in Central Vietnam, in the western part of the Thừa Thiên Huế province, and the studied area corresponds to the present-day A Lưới district (fig. 1). These mountains served as a main battleground during the Vietnam War (1961-1975). Attached to South Vietnam (fig. 2) after the Geneva Agreements (1954), they were located just south of the 17th parallel – the limit that these agreements established between North and South Vietnam. Moreover, they were crossed by the Hồ Chí Minh trail, which was actually a strategic network of roads and trails that the North Vietnamese used to provision their southern positions (fig. 3). These mountains were largely controlled by the *Việt Cộng*, and their location explains why they were a primary target of US-Vietnamese attacks, which included herbicide sprayings (fig. 2). Especially because of this practice, the Vietnam War is considered a war against the environment: "the Vietnam War of 1961-1975 stands out as the archetypal example of environmental war-related abuse" (Westing, 2002). What are the environmental consequences of this conflict in the A Lưới Mountains? Are they only visible in the landscape? Are they only direct? To answer these questions, military as well as civilian practices were studied. Knowledge was gathered via archival data and semi-structured interviews conducted in five villages. In each village, between three and five inhabitants were interviewed collectively (Robert-Charmeteau, 2015). The pre- and post-war landscapes were also mapped and compared to identify their dynamics. Information about the pre-war landscapes came from aerial photographs taken between 1950 and 1954 and acquired from France's Defence Historical Service / Air Force Department. The post-war landscapes were reconstituted by using a Landsat satellite image from 1975. The military

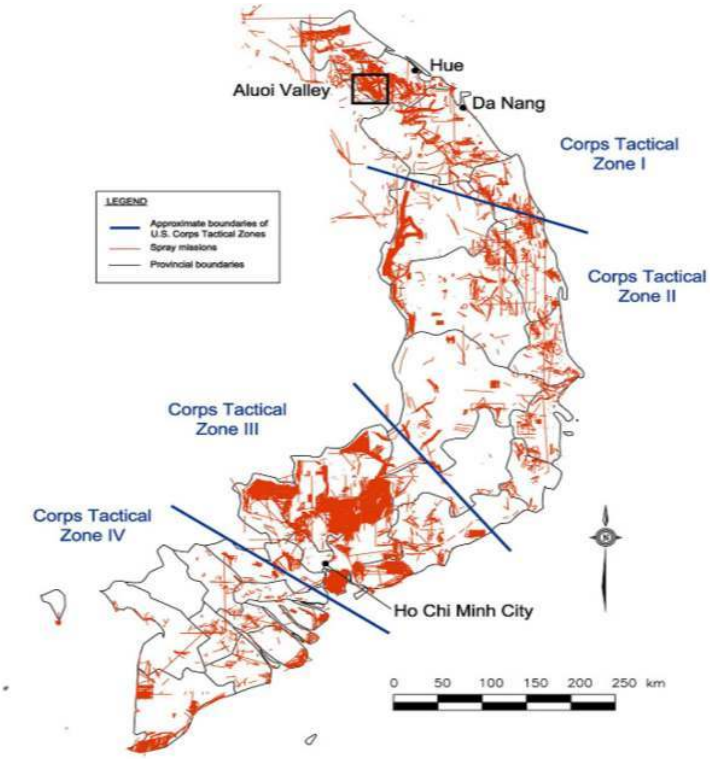
practices that could have an impact on landscapes were analysed first, before their direct and indirect consequences on the landscapes were identified.

Figure 1: The A Lưới Mountains, western district of Thừa Thiên Huế province



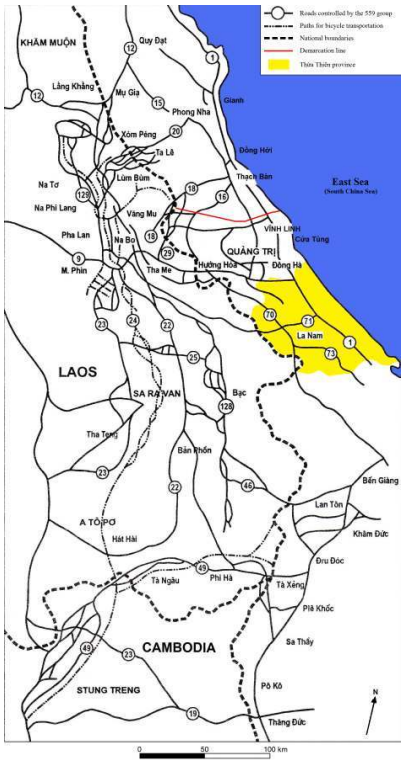
Georeferencing: UTM 48N/WGS 84 Sources:
- Relief: from the topographic map NE-48-16 (Huế) drawn in 2001 at a scale of 1:250,000 by the Mapping Office of the General Staff of the People's Army of Vietnam (from a map at a scale of 1:250,000, UTM, dated 1982, modified according to a map drawn at a scale of 1:100,000, in UTM in 1986 and an aviation map at a scale of 1:500,000 from 1994); contour lines were interpolated from the TIN (triangulated irregular network) parabolic model, without constraint;
- Districts boundaries: from the administrative map of Thừa Thiên Huế, in Cartographic Publishing House (2004), Vietnam Administrative Atlas – Tập bản đồ hành chính, Nhà xuất bản đồ (Cartographic Publishing House), Hanoi, p. 40.

Figure 2: Herbicide sprayings in South Vietnam between 1965 and 1971: the A Lưới Mountains as a major target



Source: Map from Hatfield Consultants LTD and 10-80 Committee, drawn based on data from the US Department of the Army (http://www.hatfieldgroup.com/UserFiles/File/ ContaminantMonitoringAgentOrange/VietNamHighlights/ SprayLines.PDF, accessed 6 April 2011)

Figure 3: The Hồ Chí Minh trail between 1969 and 1973, a network of ways in the Annamite Range, crossing the A Lưới Mountains



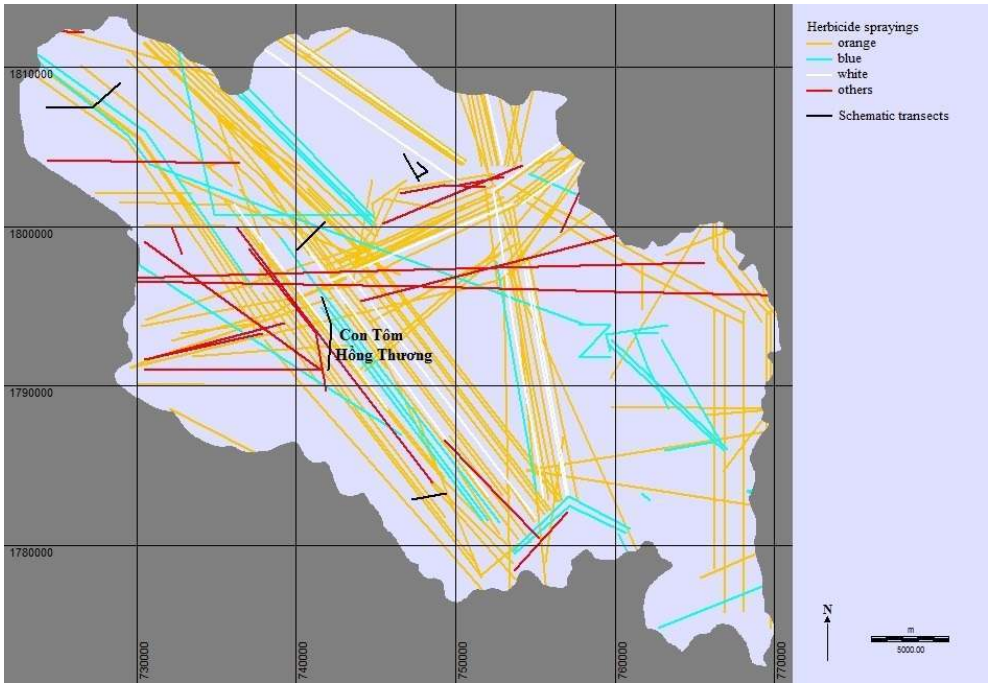
Source: Hoàng Khôi, 2002, modified map
Group 559 included the troops fighting along the Hồ Chí Minh trail.

Military practices, attacks against the environment

The US-South Vietnamese camp: environment considered as a target

2 In January 1962, the US Army launched "*Operation Ranch Hand*": It sprayed herbicides from the air in order to destroy the canopy cover, under which the enemy could hide, and the crops, which could feed him. These herbicides were applied in high concentrations and often on repeated occasions. In other words, they were used as chemical weapons pointed at the environment of the enemy, and they became ecocides. Nearly 80 million litres were sprayed, including the infamous Agent Orange, mainly over South Vietnam (Stellman *et al.*, 2003). The A Lưới Mountains were particularly affected, more than the plain of Thừa Thiên – the name given to the province during the conflict. This area, especially its main valley (fig. 4), was one of the major targets of "*Operation Ranch Hand*" (fig. 2). The communication routes, including waterways, were subjected to repeated sprayings, while the highest reliefs were relatively spared.

Figure 4: Herbicide sprayings in the present-day A Lưới district between 1965 and 1971



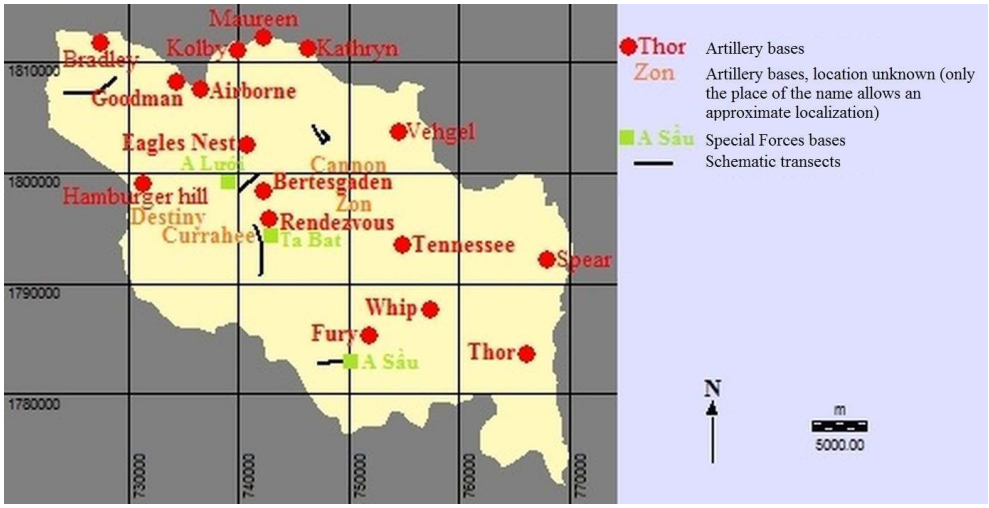
Georeferencing: UTM 48N/WGS 84
Source: from the map of the Forest Inventory and Planning Institute (FIPI), obtained in 2005 from Phùng Tửu Bôi, botanist, former director of FIPI's environmental service, director of ANCODEC (Assistance for Nature Conservation and Community Development Center, an ONG) and researcher internationally renowned for his study of the environmental consequences of herbicide sprayings. Map drawn from C. Smith and D. Watkins, 1981. *The Vietnam Map Book: A Self-help Guide to Herbicide Exposure*, Winter Soldier Archive, Berkeley, CA, 107 p.

3 The impact of herbicide sprayings is controversial (Robert, 2011), but in the case of dense forests it seems to vary especially according to the number of sprayings:

4 "In those upland forests that were subjected to one spraying (an estimated 1.5 million hectares), a minimum of 10 per cent of the overstory trees, and often two to three times that fraction, have been killed [...]. (One experienced logger whom we interviewed insisted that only 30 per cent of the timber trees survive one spraying.) In the multiply-sprayed upland forests, estimated at 0.4 million hectares, at least half, and sometimes all, of the trees have been killed" (Westing, 1972).

5 Besides those carried out from the air, some sprayings were conducted on the ground, especially around US bases, which were scattered across the studied territory (fig. 5). The main bases were the ones of the Special Forces: A Lưới, Ta Bat and, above all, A Sầu. Herbicides were stored at these bases. At all the bases, including the artillery ones, the soil was often bare – some photos taken during the war prove this point (Robert, 2011). The total destruction of vegetation and the laying bare of the soil were achieved by other means, such as fire and bulldozers, which appeared in the US-South Vietnamese arsenal at the end of 1969. They were considered to be more effective against vegetation – "the clear tactical superiority of the 'Rome plow' [...] land-clearing programme" – and they even contributed to the decline of the defoliation programme (Westing, 1972). However, it was not possible to verify whether they were used in A Lưới.

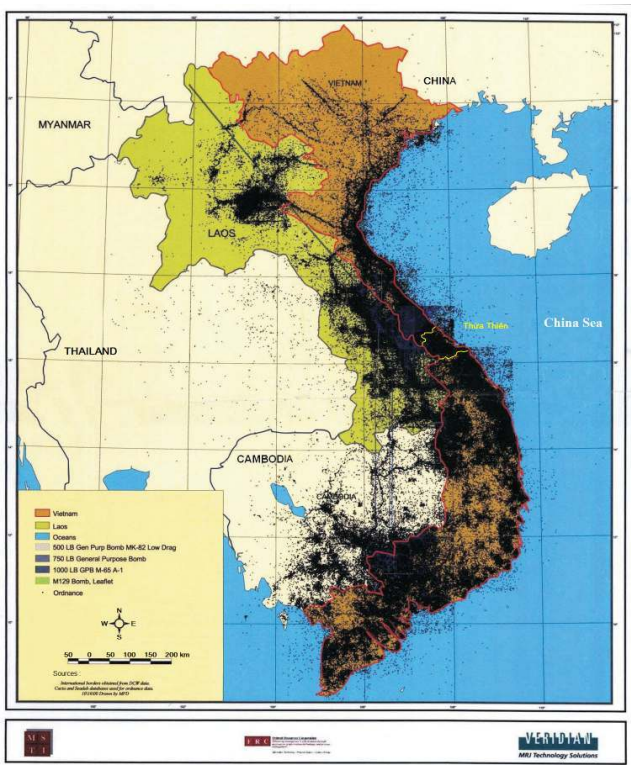
Figure 5: Main US military bases established in the present-day A Lưới district



Georeferencing: UTM 48N/WGS 84
Source: from the "Hue, Vietnam, Laos: Joint Operations Graphic (AIR)" map, MAP12100118 [map], at a scale of 1:250,000, 1501 AIR Series, Defense Mapping Agency Hydrographic/Topographic Center, September 1983, Vietnam Archive Map Collection, The Vietnam Archive, Texas Tech University, http://www.virtualarchive.vietnam.ttu.edu/starweb/virtual/vva/servlet.starweb, accessed 24 February 2008
Remarks: Some bases are only approximatively located because they were not on the source, unlike the other ones that were precisely marked on the source material with a point. All of them were *a priori* added onto the original source map. It was not possible to mention all the bases on the map, although the information obtained thanks to the main source was completed by using maps from the North of the I Corps Tactical Zone (http://www.327infantry.org/second/nicorpsmap, accessed 11/14/2009). The bases of the Special Forces, which neither of the sources noted, were added.

6 The landscapes were also altered by another US military practice: bombings. They formed craters and mutilated and destroyed the surrounding trees. Similar to the First World War in France (Gaudemard, 1994), some trees appeared strafed: "Extending far beyond the dimensions of the opening in the forest created by the bomb strike is the damage to living trees caused by shrapnel" (NAS, 1974). Nevertheless, the destruction of trees was limited. A larger area could be affected in the case of incendiary – for example, napalm – bombs. The Thừa Thiên province was among the most bombed-out areas (fig. 6), and its mountains, especially the ones of A Lưới, were particularly affected, as the bombings were intense.

Figure 6: US aerial bombing in South-East Asia, *a priori* between 1965 and 1975



Source: Hatfield Consultants Ltd (ordnance display prepared by the *Federal Resources Corporation*, Washington, D.C.), http://www.hatfieldgroup.com/files/bombs_vietnam.pdf, accessed 5 February 2006 (http://www.hatfieldgroup.com/UserFiles/File/ContaminantMonitoringAgentOrange/VietNamHighlights/bombs _vietnam.pdf, accessed 6 April 2011), modified map. Georeferencing in latitude/longitude.
DCW: *Digital Chart of the World* – Cacta: *Combat Air Activities file*, October 1965-December 1970 – Seadab: *Southeast Asia Database*, January 1970-June 1975 – MFD: *a priori Multi-Function Display*.

7 Although it is a challenge to identify the bombs, represented with coloured patches, it was not possible to remedy this defect. The meaning of the line crossing Laos remains unknown.

8 These practices, especially the herbicide sprayings, had impacts on ecosystems, and that is why the Vietnam War is considered a war against the environment. In the Thừa Thiên province, because of its strategic position, the A Lưới area is the one where the military practices were the most intense and the destructions were the most important: It is a mountainous border area, where the *Việt Cộng* found refuge. Because of their military practices, these fighters could alter the landscapes and cause destruction.

Destruction caused by the *Việt Cộng*

9 During the war, the A Lưới Mountains suffered significant damage, in particular deforestation because of military practices, but these impacts were not only due to the US-South Vietnamese side. Although rarely mentioned in literature, the *Việt Cộng* also destroyed part of the environment, especially along the Hồ Chí Minh trail. One reason for the lack of records could be that the Vietnamese military archives are still inaccessible. Failing that, some books written by Vietnamese (Hoàng Khôi, 2002; Đồng Sĩ Nguyên, 2005)

do provide heuristic accounts, scriptural and photographic evidence (Robert, 2011) that made the *Việt Cộng* practices more well-known.

10 As mentioned, the Hồ Chí Minh trail was not a single road. It was a large network of many roads and trails (fig. 3). New land routes were continually opened, especially based on operations (Đồng Sĩ Nguyên, 2005). Their construction destroyed vegetation and levelled the relief (Robert, 2011, from gathered photos). The tools were rudimentary at first, like during the Indochina War: "As early as 1945 and during the early days of the war, groups of cadres [...] travelled southwards on foot to open the way along the length of Trường Sơn. Their tools were merely bush-whackers and pick-axes" (Hoàng Khôi, 2002). These tools used at the beginning were subsequently perfected. Bulldozers were mentioned from January 1967 along the Hồ Chí Minh trail (Đồng Sĩ Nguyên, 2005). Thus the *Việt Cộng* used them before US soldiers did as a "weapon". But the *Việt Cộng* also took advantage of enemy bombings. At least, Đồng Sĩ Nguyên (*op. cit.*), leader of Group 559, envisaged this option at the beginning of 1967:

11 "A number of bomb craters could be reshaped into shelters for inactive bulldozers and transport vehicles. [...] It is necessary to exploit to the maximum the destruction caused by enemy bombs in the both sides of roads to broaden them and enable several vehicles to drive alongside. The adversary has apparently given us explosives for road building."

12 The construction of infrastructure, like bridges, to facilitate movements caused deforestation, even if it seems insignificant in comparison with the large-scale destruction inflicted by the US. The materials, taken from plants, were collected on the spot (Robert, 2011). Besides these impacts of the road openings, "the continual movement of troops and war machinery (tanks and artillery pieces) increased the damage" (Brindley, 1973, transl.) caused to the environment.

13 Some construction work was also carried out in the area. Even if it was rudimentary, it still caused deforestation and alterations. Trees were felled to allow for the passage of the oil pipeline, which ran along the Hồ Chí Minh trail, or to put in medical or technical infrastructure (warehouses or vehicle repair workshops etc.; Robert, 2011, according to the gathered photos) and military stations. The ground was moved while trenches and tunnels were being dug for the *Việt Cộng* and inhabitants to take shelter. Besides this deforestation, we should consider the impoverishment that occurred near these spots due to the collection of firewood and wood used for the construction of facilities, shelters or other infrastructures.

14 The *Việt Cộng* also caused damage with land mines that they often put near the villages (Kaspi, 2004), causing loss of human life in the opposite camp and destruction. Fire also led to further deforestation: "One of the main causes of forest destructions in Vietnam is currently fire. Some fires are deliberately caused by the Vietnamese Army" (Orians and Pfeiffer, 1970, transl.).

15 The forest allowed the *Việt Cộng* to hide. The relief played the same – perhaps a greater[1] – role. And it explains why the mountains, particularly the ones of A Lưới, served as a refuge area for these fighters. There, the forests were dense and wider than in the other landscape units (Robert, 2011). The US-South Vietnamese camp thus conducted war against this environment, of which the enemy took advantage by targeting the forests in particular. "Mostly, the devastation is caused by the US Army" (Brindley, 1973, transl.), but the *Việt Cộng* also caused destruction. The military practices of both camps thus had direct consequences on the landscapes, but they also had indirect impacts.

Direct and indirect impacts on the landscapes

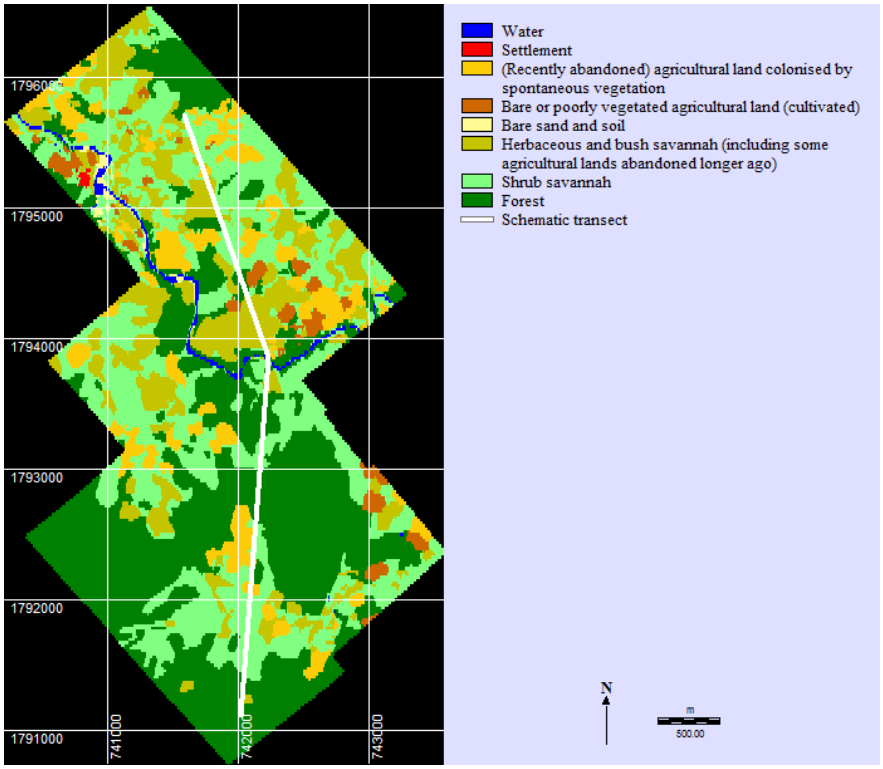
16 Military practices altered the landscapes. But to what extent were they factors of landscape dynamics during the war? What was their share of the responsibility? Was the forest decline the result of these practices and of these practices alone? To answer these questions, it is necessary to reconstruct the pre- and post-war landscapes and to study the civilian practices, their development and their impacts during the conflict.

Landscape dynamics during the war

17 The fighters' practices during the war are the cause of regressive landscape dynamics. They indeed destroyed the vegetation, with reservations for herbicides: As we have already mentioned, forest regression only occurred when sprayings were repeated. It is challenging to identify the impact of each practice because neither the effects of each one on its own nor those of all of them combined can be precisely localized. Only the overall impact of the conflict can be assessed, at least in certain parts. Because of the sources (aerial photographs) used for the pre-war inventory, their time processing and because they were incomplete (these photographs do not cover the southern part of the present-day A Lưới district), the dynamics that occurred during the war are known only along certain transects. Like the satellite image of 1975, these sources were selected because they are original and are thus *a priori* unbiased. This criterion is all the more important because the topic is controversial. These sources were also the only ones that were available to form an idea of the state of the landscapes at the time.

18 The aerial photographs showed land use around 1954, like along the Con Tôm Hồng Thương transect, which is located in the heart of the A Lưới Valley and is here taken as an example (fig. 7). They contradict the assertions of some authors who exaggerate the presence of pre-war forests by claiming their ubiquity, particularly in this valley (Vo Quy, 2005; Lê Trọng Cúc, 1983). This ubiquity was also noted by the mountain-dwellers interviewed in several villages, including Con Tôm Hồng Thương. In this case, the reason is probably that they did not distinguish forests from shrub savannahs. According to these iconographic sources, the forests were wider than on the plain (Robert, 2011). But they disappeared in the valleys, on the less steep grounds, and gave way to shrub, herbaceous and bush savannahs and agricultural lands: Some of these ones were cultivated, and others were abandoned, left to be colonised by spontaneous vegetation (fig. 7). Dense (according to the villagers' accounts; Robert-Charmeteau, 2015) forests extended to the steepest nearby slopes and then on all of the most distant slopes. In the valleys, above all in the main one – the A Lưới Valley (the northern part of the Con Tôm Hồng Thương transect) – the landscapes thus formed a patchwork dominated by sylvosystems at different stages.

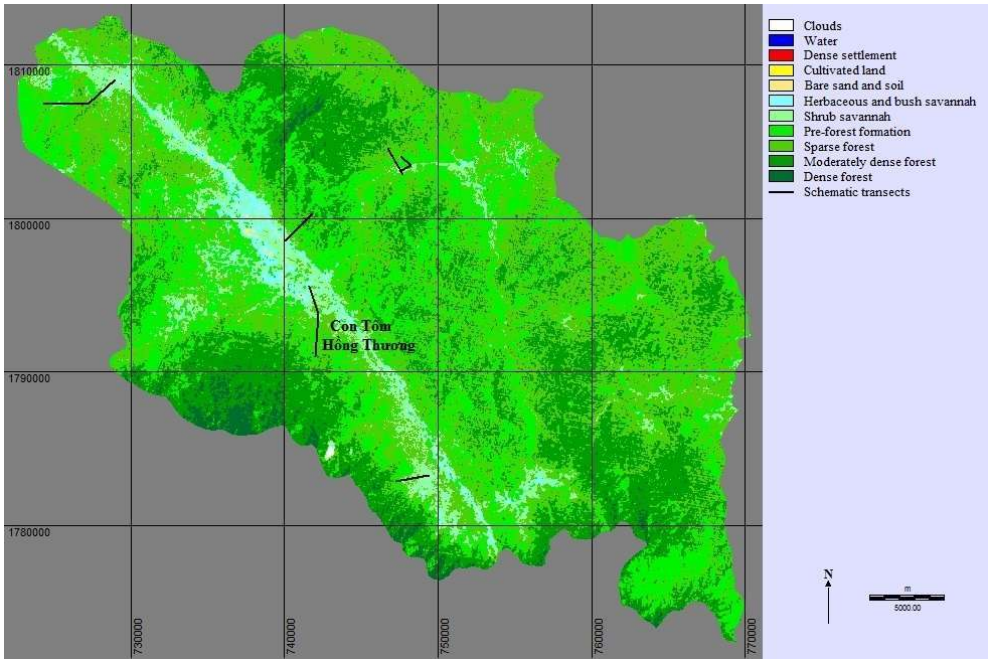
Figure 7: Land use along the Con Tôm Hồng Thương transect in 1952



Georeferencing: UTM 48N/WGS 84
Sources: from aerial photographs taken 25 November 1952 (France's Defence Historical Service / Air Force Department, 605-A Plot, TV 613 mission). For the localisation of the transect, see Figure 4.

19 Land use in 1975 is known for all the studied areas (fig. 8). The savannahs, herbaceous and bush first, extended over the A Lưới Valley and its nearby slopes, whereas the most distant slopes were covered by more advanced sylvosystems – pre-forest formations (called "in the process of forest reconquest", according to the considered Vietnamese classification), sparse forests and, on the higher reliefs, moderately dense and dense forests.

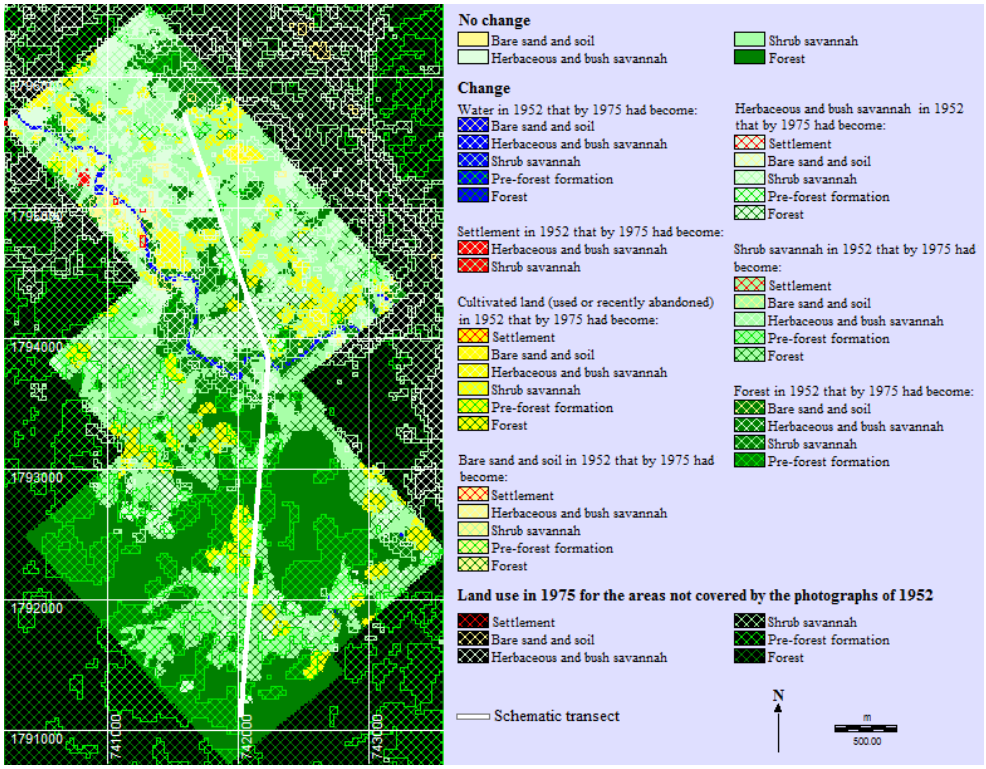
Figure 8: Land use in the present-day A Lưới district in 1975



Georeferencing: UTM 48N/WGS 84
Source: from the Landsat 2 MSS satellite image taken 14 March 1975 (processed with Idrisi Kilimanjaro sofware)

20 Just as accounts exaggerated the presence of pre-war forests, so too did they exaggerate the presence of the savannahs after the war. The villagers and some authors overestimated the impact of the war, and we can read that “Before the start of the chemical war, A Luoi was covered by a dense forest”; “The chemical war changed the A Luoi district into a sinister theater: the forests of the 21 victim communes were destroyed, with the exception of a corner in the south of the commune of Hung Nguyen [actually Hương Nguyên, at the southern end of the district]” (Lê Trọng Cúc, 1983, transl.). The forest decline is real, but it is moderate, based on a reading of the maps drawn of the landscape dynamics, including the one of Con Tôm Hồng Thương (fig. 9). This map shows a higher complexity of the dynamics, even if it might be strengthened by the difference of the sources’ spatial resolution (Robert-Charmeteau, 2015).

Figure 9: Landscape dynamics along the Con Tôm Hồng Thương transect between 1952 and 1975



Georeferencing: UTM 48N/WGS 84
Sources: cf. the sources for figures 7 and 8. For the localisation of the transect, see figures 4 or 8.

21 North of the A Sap River (fig. 9), the tatters of the pre-war forests disappear, regressing towards the savannah stage. In the south, the dynamic was identical for the forests near the river. Beyond, on the higher reliefs where the forests extended farther in 1952, the regression was only partial. The regressive dynamics did not end up only with the disappearance of forests: They also concerned the savannahs, in a limited area, especially in the north of the map – towards the bare soil stage or, for the shrub savannahs, towards the herbaceous and bush stage.

22 Not all of the sylvosystems suffered a regressive dynamic. Some remained at the same stage. To the north of the A Sap River, it was above all the savannahs that remained (fig. 9). In the south, especially on the higher reliefs, it was the forests. However, these ones could also suffer disturbances. Indeed, all disturbances do not lead to the disappearance of forests: Some led to bifurcations. In this case, the regressive dynamic do not mean a return to a non-forest stage. But it could not be checked with the classes, which were selected here according to the identification possibilities that the sources provided. However, some progressive dynamics were perceptible.

23 The forest could make some progress along the undulations located to the north of the A Sap River (fig. 9), like at the water catchment areas of the Con Tôm River (farther south). This spread would have occurred at the expense of the herbaceous, bush and shrub savannahs. But this is doubtful given the time required for the progression from a herbaceous and bush savannah to a moderately dense forest. The change of the savannahs into pre-forest formations is more plausible. It could be observed in limited

areas to the north of the A Sap River, and in wider areas in the south. The savannahs also progressed from the herbaceous and bush to the shrub stage, especially in the north.

24 How to explain these progressive dynamics that took place during the war? Military practices weakened the sylvosystems and caused them to regress, but the war had other consequences, too: It altered civilian practices.

Alterations of civilian practices, the indirect impacts

25 Before the war, semi-nomadic ethnic minorities inhabited the A Lưới Mountains (Robert, 2011; Robert-Charmeteau, 2015). These peoples practised slash-and-burn cultivation, which explains the fragmentation of the landscape in 1952, as was previously noted. The lands were cultivated for one to three years. They then lay fallow and were progressively colonised by the forest, before being again cultivated. The mountains-dwellers were clustered in villages. They lived in osmosis with the forests, which provided them with all the resources they needed (*ibid.*).

26 When the Vietnam War broke out, the A Lưới Mountains, the main valley first, became a refuge area for the ethnic minorities who lived close to the plain, according to villagers' accounts. Even so, the fighting already had an impact on the civilian practices of the mountains-dwellers, like the accounts given *in situ* made clear. Herbicide sprayings and bombings sometimes destroyed the cultivated lands, and thus the villagers worked in vain. Consequently, they reduced the cultivated area ever more because they were scared for their lives. The forest products were also collected from shorter distances.

27 At the end of 1960s, the intensity of the battles in the area increased, and many people fled from the valley to take refuge around Laos. The villages were deserted, and the land was no longer cultivated. The spontaneous vegetation once again colonised these spaces, which explains the progressive dynamic that we noted for some sylvosystems during the war. The military practices forced the mountains-dwellers to alter their practices then to flee. They were thus indirectly the cause of the progression of some sylvosystems. However, this one went along with some regressions for other sylvosystems. In fact, in the refuge areas, smaller new lands were being cultivated. The villagers also built rudimentary shelters using materials available on the spot. The fires that were set in order to cultivate or cook were limited to avoid being located and targeted by the US-South Vietnamese attacks. Not all the mountain-dwellers ended up fleeing: Some stayed behind while others, including those who had lived elsewhere before the war, even went into the valley to fight alongside the North Vietnamese Army. They also adapted their practices to the new context of war. They sought shelter in tunnels and lived on products they gathered from the forest. During the flight of civilians, no land was cultivated in the main valley.

28 As soon as the battles stopped, the refuge areas were abandoned and colonised by the spontaneous vegetation. The villagers who had lived in the valley before the battles returned to their home villages, which was the case for people living around the Con Tôm Hồng Thương transect. Others followed, such as those whose villages before the war were in secondary valley and less easily reachable from the plain. In fact, by request of the Vietnamese government, the ethnic majority, the *Kinh*, settled in the A Lưới Valley after the war.

29 Before the war, the *Kinh* looked upon the mountains with revulsion (Gourou, 1940), and thus only ethnic minorities inhabited the A Lưới area. When the Indochina War (1945-1954) broke out – it had a small impact on the studied area –, the *Kinh* showed an "initial reticence to fight in forest" (Marill, 1994, transl.). Even so, "the Viêt-minh [...] knew how to adapt to the tropical jungle to outlive and resist the French Army" (*ibid.*, transl.). From a hostile environment, the forest even transformed into a protective refuge, whither the soldiers withdrew when they felt threatened (Robert, 2011). During the Vietnam War, the ones who fought for the liberation of South Vietnam took up refuge in the mountains, including in A Lưới, and set up base there. The revulsion for the mountains and their forests seemed to soften, so much so that after the war, admittedly by the request of the Vietnamese government, the *Kinh* settled in areas that had previously been deserted, like the A Lưới Mountains. Thus appears the idea that the war, through the destruction of vegetation and the opening of new ways, facilitated access to the mountains and gave the opportunity to the *Kinh* to become familiar with this area and to extend their influence to the ethnic minority (*ibid.*). They also perceived the stakes of this border area. The arrival of the *Kinh* in the area had the goal of securing the border. The settlement of ethnic minorities had the same objective. The war thus altered the *Kinh* 's perception of the mountains and their forests. However, by settling, they also increased the pressure on sylvosystems and largely contributed to the acceleration of the post-war decline of the forest (Robert, 2011; Robert-Charmeteau, 2015).

30 By altering civilian practices, the military practices had indirect consequences on the landscapes and their dynamics.

Conclusion

31 Because of their strategic position, the A Lưới Mountains were a refuge area for the *Việt Cộng*. Moreover, the canopy cover of their dense forests and their reliefs allowed these fighters to remain hidden. The *Việt Cộng* took advantage of this environment, which is why it was targeted by the opposite side. The A Lưới Mountains were among the areas most affected by the herbicide sprayings and bombings carried out by the US-South Vietnamese troops. Besides these disturbances, the *Việt Cộng* added other ones. Their military practices also had an impact on the environment, even if, for the most part, the damage was more limited. The military practices were intense in the A Lưới Mountains, and they altered the landscapes. The identification of landscape dynamics was based on iconographic data, and it confirmed the regression of sylvosystems during the war. But it contradicts the most alarmist points of view. The savannahs of 1975 were not the result of military practices alone. Before the war, the forests had dominated but were not ubiquitous. Furthermore, by altering the civilian practices, the war also indirectly caused progressive dynamics. It was an opportunity for the *Kinh* to become more familiar with this area, which until then had been deserted. After the war, some moved there, whereas the ethnic minorities were settled. The purpose was to secure this border area. Pressure on the sylvosystems increased, and the forest decline accelerated. Post-war civilian practices soon compromised the healing of the ecosystems that had been affected by the conflict, worsening the strict impact of the war.

BIBLIOGRAPHY

Brindley T., 1973.– "A legacy of poison", *Far Eastern Economic Review*, March, translated into French under the title "Les conséquences écologiques de la guerre au Vietnam", *Problèmes Economiques*, June, no. 1, 328, La Documentation Française, pp. 29-32.

CVN (Courrier du Việt Nam), 1970.– "La défoliation, partie intégrante du génocide" and "Témoignages", *Courrier du Vietnam*, March, Hanoi, reworked from *Problèmes politiques et sociaux*, no. 44, "La guerre chimique et biologique - Un cas concret : la "défoliation" au Vietnam", La Documentation Française, pp. 10-13.

Đồng Sĩ Nguyên, 2005.– *The Trans-Trường Sơn Route (A memoir)*, English translation of *Đường xuyên Trường Sơn* (2001), Thế Giới, Hanoi.

Gaudemard F., 1994.– "Les bois mitraillés dans le département de la Marne", in Corvol A., Amat J.-P. (dir.), *Forêt et Guerre*, Groupe d'Histoire des Forêts Françaises, L'Harmattan, Paris, pp. 193-196.

Gourou P., 1940.– *L'utilisation du sol en Indochine française*, Publications du Centre d'études de politique étrangère, Paris.

Hoàng Khôi, 2002.– *The Hồ Chí Minh Trail*, English translation of *Đường Mòn Hồ Chí Minh*, Thế Giới, Hanoi.

Kaspi A., 2004.– "Au cœur de la "sale guerre"", *Les collections de l'Histoire*, n° 23, pp. 72-79.

Lê Trọng Cúc, 1983.– "Les effets durables de la guerre chimique sur l'environnement du district [d']A Luoi - province [de] Binh Tri Thien", in Comité national d'investigation des conséquences de la guerre chimique américaine au Viet Nam (National Committee investigating the consequences of US chemical warfare in Vietnam), *Les herbicides et défoliants employés dans la guerre : les effets à long terme sur l'homme et la nature*, Symposium international, 13-20 January 1983, Ho Chi Minh City, Vol. II, Hanoi, pp. 137-139.

Marill J. M., 1994.– "Le combat en forêt tropicale humide", in Corvol A., Amat J.-P. (dir.), *Forêt et Guerre*, Groupe d'Histoire des Forêts Françaises, L'Harmattan, Paris, pp. 111-114.

NAS (National Academy of Sciences), 1974.– *The Effects of Herbicides in South Vietnam, Part A - Summary and Conclusions*, Committee on the Effects of Herbicides in Vietnam, Division of Biological Sciences, Assembly of Life Sciences, National Research Council, National Academy of Sciences, Washington.

Orians G. H., Pfeiffer E. W., 1970.– "Effets écologiques de la guerre au Viet-Nam", *Raisons présentes*, Oct./Nov./Dec., Editions rationalistes, Paris, pp. 105-119.

Portes J., 2008.– *les États-Unis et la guerre du Vietnam*, Editions Complexe.

Robert A., 2011.– *Dynamiques paysagères et guerre dans la province de Thừa Thiên Huế (Việt Nam central), 1954-2007 - Entre défoliation, déforestation et reconquêtes végétales*, Ph.D. thesis presented and defended in public on December 3, under the supervision of Professor J.-P. AMAT, Université Paris-Sorbonne.

Robert-Charmeteau A., 2015.– "Les impacts de la guerre du Việt Nam sur les forêts d'A Lưới", *VertigO*, vol. 15, n° 1, published online 20 June 2015, http://vertigo.revues.org/16105

Stellman J. M., Stellman S. D., Weber T., Tomasallo C., Stellman A. B., Christian R., 2003.– "A Geographic Information System for Characterizing Exposure to Agent Orange and Other Herbicides in Vietnam", *Environmental Health Perspectives*, vol. 11, no. 3, pp. 321-328.

Vo Quy, 2005.– "Ecocide, recherche et réhabilitation de l'environnement", in AAFV (Association d'Amitié franco-vietnamienne), *L'agent orange au Viêt-nam – Crime d'hier Tragédie d'aujourd'hui*, Editions Tirésias, collection "Ces Oubliés de l'Histoire", Paris.

Westing Ar. H., 1972.– "Herbicides in war: Current Status and Future Doubt", *Biological Conservation*, vol. 4, no. 5, pp. 322-327.

Westing Ar. H., 2002.– "Assault on the environment", in Westing Ar. H. *et al.*, *Long-term Consequences of the Vietnam War - Ecosystems*, Report to the environmental conference on Cambodia, Laos, Vietnam (26-28 July), Föreningen Levande Framtid, Sweden, pp. 2-4.

NOTES

1. "After an inspection on the spot, Roger Hilsman (quoted by Seymour Hersh in CBW in Vietnam), the former head of the Intelligence Service of the State Department, noted that 'the leaves were gone, while the branches and trunks remained. And even if they didn't, the guerrilla rather used outlines of paths, hills and valleys than branches or leaves to hide'" (CVN, 1970, transl.).

ABSTRACTS

In the western part of the Thừa Thiên Huế province in Central Vietnam, the A Lưới Mountains were strongly affected by the Vietnam War (1961-1975). They were a refuge area for the *Việt Cộng* and crossed by the Hồ Chí Minh trail, which served as a strategic axis for them. Numerous herbicide sprayings and bombings, including napalm, struck the mountains and had a greater intensity than was the case in other landscape units. The US-South Vietnamese troops, which committed these practices, conducted a war against the enemy's environment. But the enemy was also responsible for damage in this regard. In particular, the *Việt Cộng* used bulldozers to construct several routes on the Hồ Chí Minh trail. Maps of the land used around 1954 and in 1975 were drawn along transects; a comparison between them shows the landscape dynamics that occurred during the war. Some sylvosystems of the mountain area of A Lưới regressed, especially in the main valley. But as an indirect consequence of the war, others made progress. Because of the fighting, mountain-dwellers belonging to minority ethnic groups changed their practices and then left the area, thus leading to forest recovery on the disused land. For the *Kinh*, the ethnic majority group, the war was an opportunity to become more familiar with the mountain area that they had previously neglected.

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Keywords: Vietnam, war, herbicides, mountains, forest

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